Armed Forces College of Medicine

AFCM

Female Reproductive system

Fallopian tube, Uterus and Vagina

Asmaa Abdelmonem Abo Zeid

Ass. Prof./ Histology Department

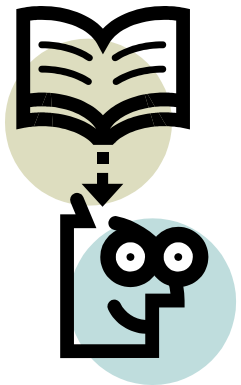
INTENDED LEARNING OBJECTIVES (ILO)

By the end of this lecture the student will be able to:

1. Describe the microscopic structure of the body of the uterus, cervix, uterine tube and vagina.
2. Analyze the structure of the endometrium at different phases of the menstrual cycle.
3. Interpret the histological changes in the uterus, cervix, uterine tube and vagina in various diseases

Assignment

What are hormones secreted by the ovary and cells synthesizing them?



Oviduct (fallopian tube)

They are paired muscular tubes.

Anatomical parts:

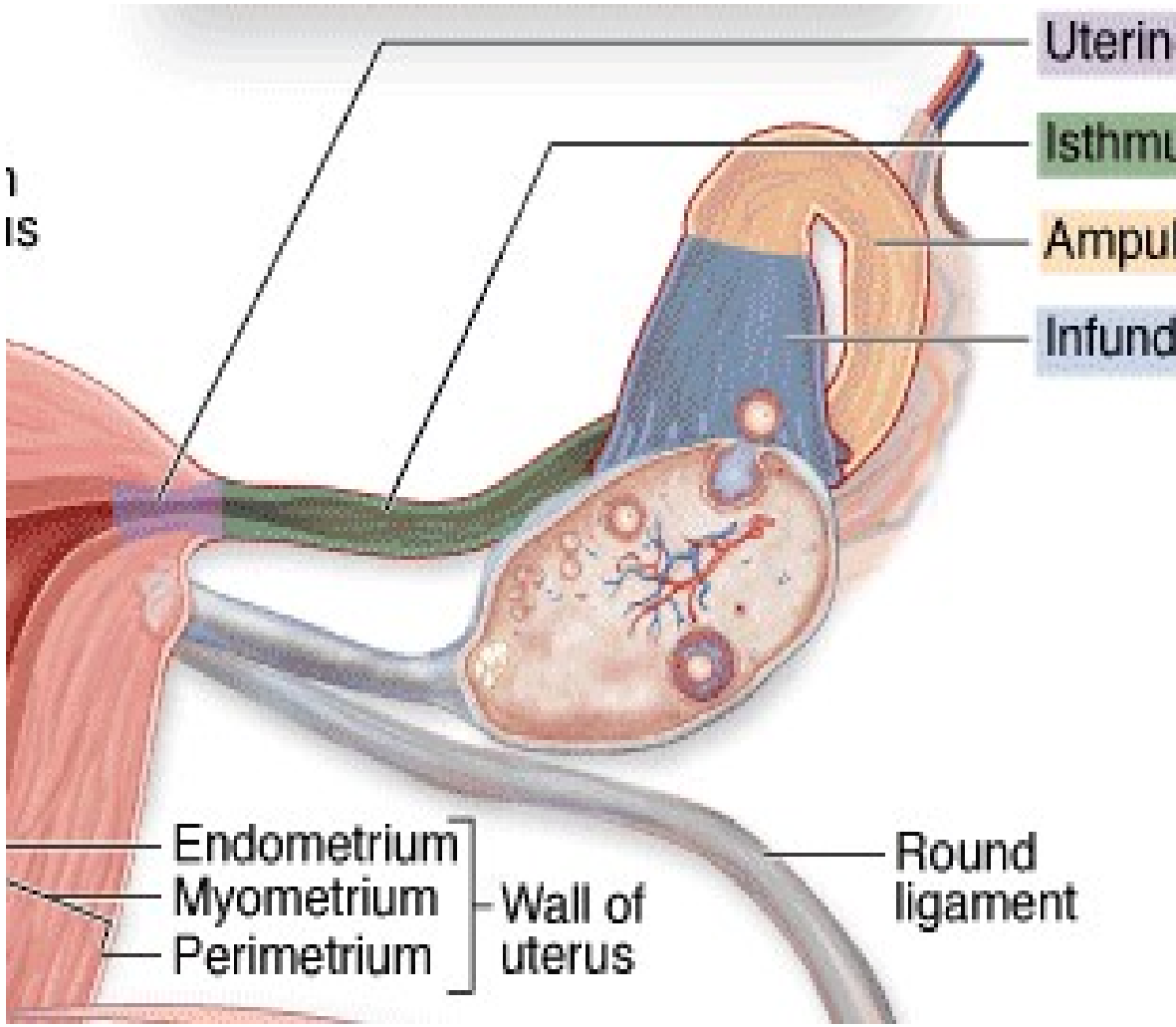
A- Intramural part :embedded in the uterus.

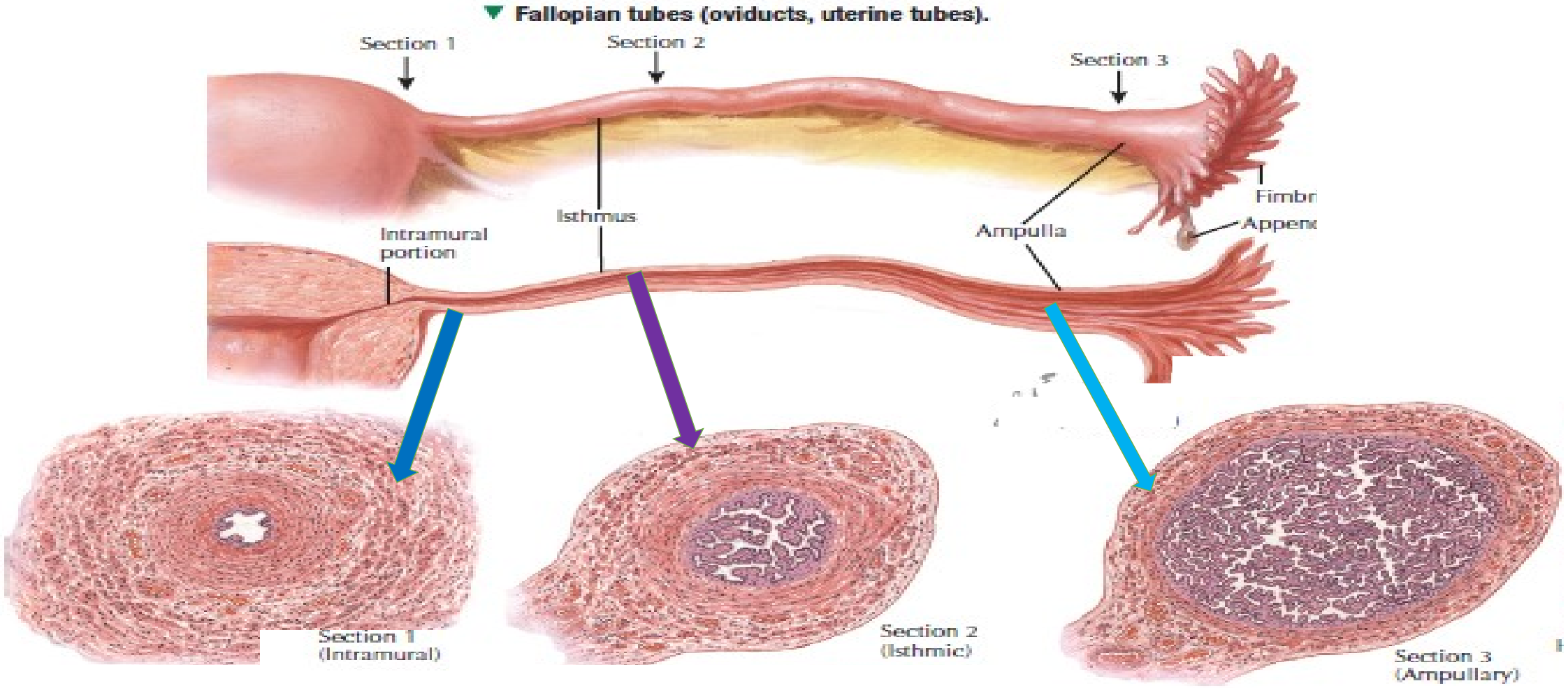
B- Isthmus: narrow, near uterus.

C- Ampulla: widest, middle segment. It has extensive mucosal folds → ***labyrinth.***

➢Fertilization takes place in the ampulla near its junction with isthmus.

D- Infundibulum: is the distal funnel-shaped → opens in peritoneal cavity. The free distal end forms number of finger like process known as fimbriae.




Fallopian tubes (oviducts, uterine tubes).
Section 1
Section 2
Section 3
Isthmus
Intramural portion
Ampulla
Fimbr
Apper
Section 1 (Intramural)
Section 2 (Isthmic)
Section 3 (Ampullary)

Histological structure

1- Mucosa:

The mucosa of fallopian tube shows extensive folds (1ry, 2ry,3ry) → *labyrinth.*

- Epithelium: simple columnar of 2 types:

A. Ciliated cells:

- **Cilia beat towards the uterus to sweep fluid and help movement of fertilized ovum toward uterus .**

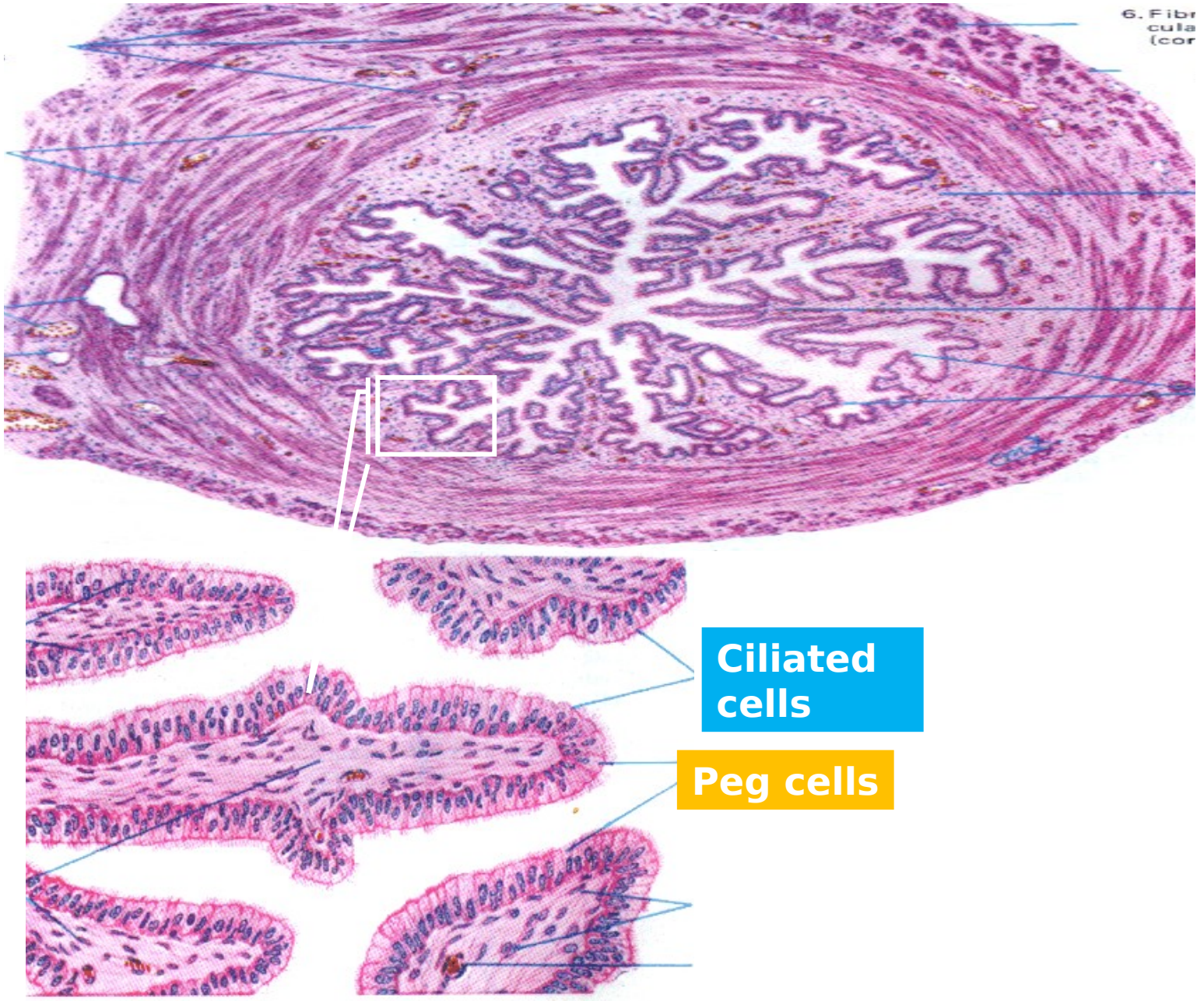
B. Secretory cells (peg cells): often with apical bulge into lumen, which secret glycoproteins → for nutrition of oocyte & zygot, capacitation & protection of sperms.

- Lamina propria. (loose CT)

2-Muscular layer: I.C. & O.L. → peristaltic movement helps in transfer of fertilized ovum towards the uterus.

3-Serosa.

Note: Ciliary action is not essential, so women with immotile cilia syndrome (Kartagener's syndrome) will have a normal tubal transport of the ovum. Contraction of the muscle layer transports the ovum or fertilized egg (zygote) to the uterus.


Ciliated cells
Peg cells

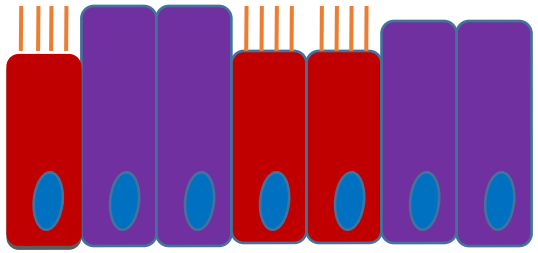
Cyclic changes in the fallopian tubes

1- *Before ovulation (under effect of estrogen):*

- ↑ **height of both ciliated and peg cells**
- ↑ **number of cilia**

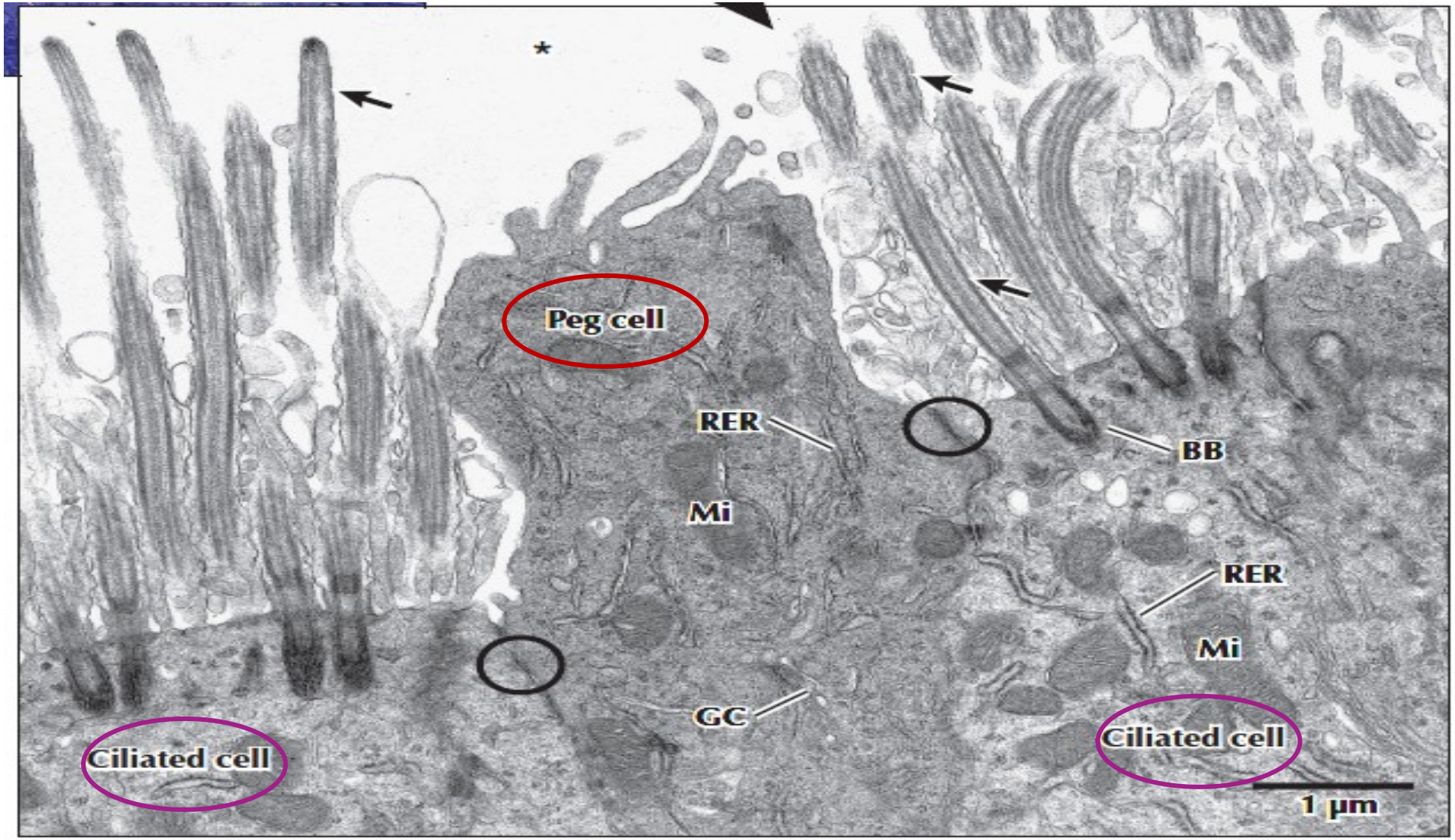
2- After ovulation (under effect of progesterone):

- Both types of cells undergo atrophy with loss of cilia.



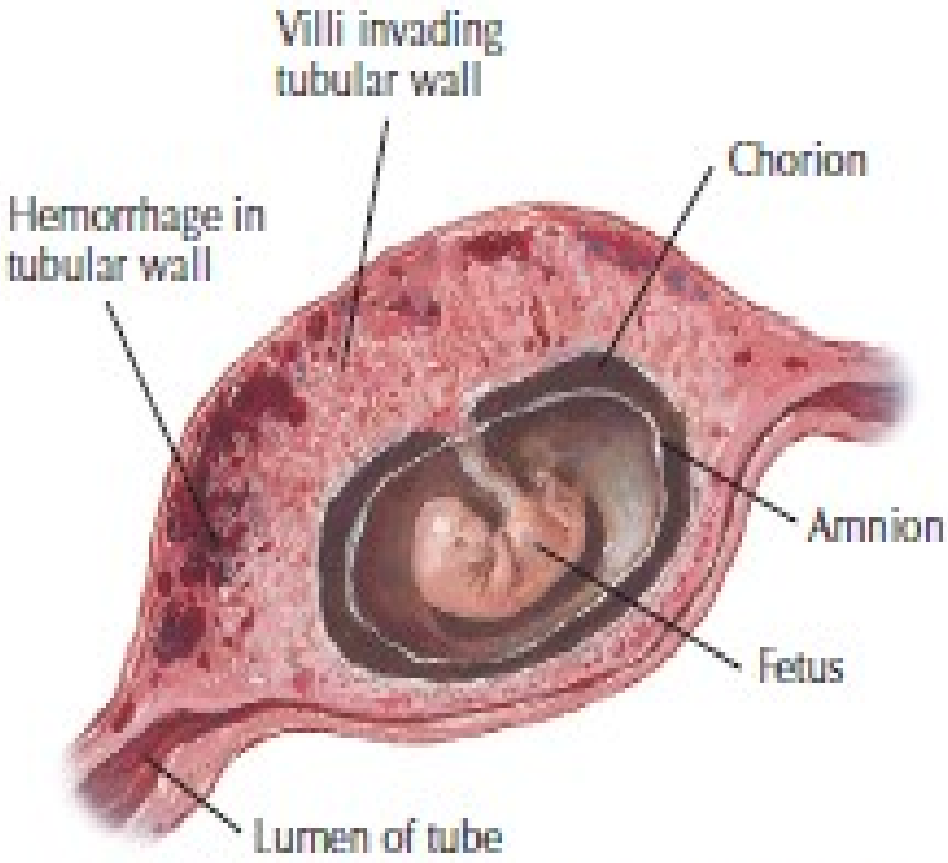
PEG CELLS
(MOST ACTIVE STATE SHORTLY AFTER OVULATION)

E/M of fallopian tube epithelium



Ectopic pregnancy

- **If there is blockage of embryo transport to the uterus (e.g. salpingitis). T**he fertilized ovum implants, most commonly in the wall of the ampulla of the oviduct
- Partial development proceeds for a time but the tube is too thin and the embryo cannot survive.
- The vascular placental tissues that have penetrated the thin wall cause brisk bleeding into the lumen of the tube and peritoneal cavity when the tube bursts.



△ Section through tubal ectopic pregnancy.

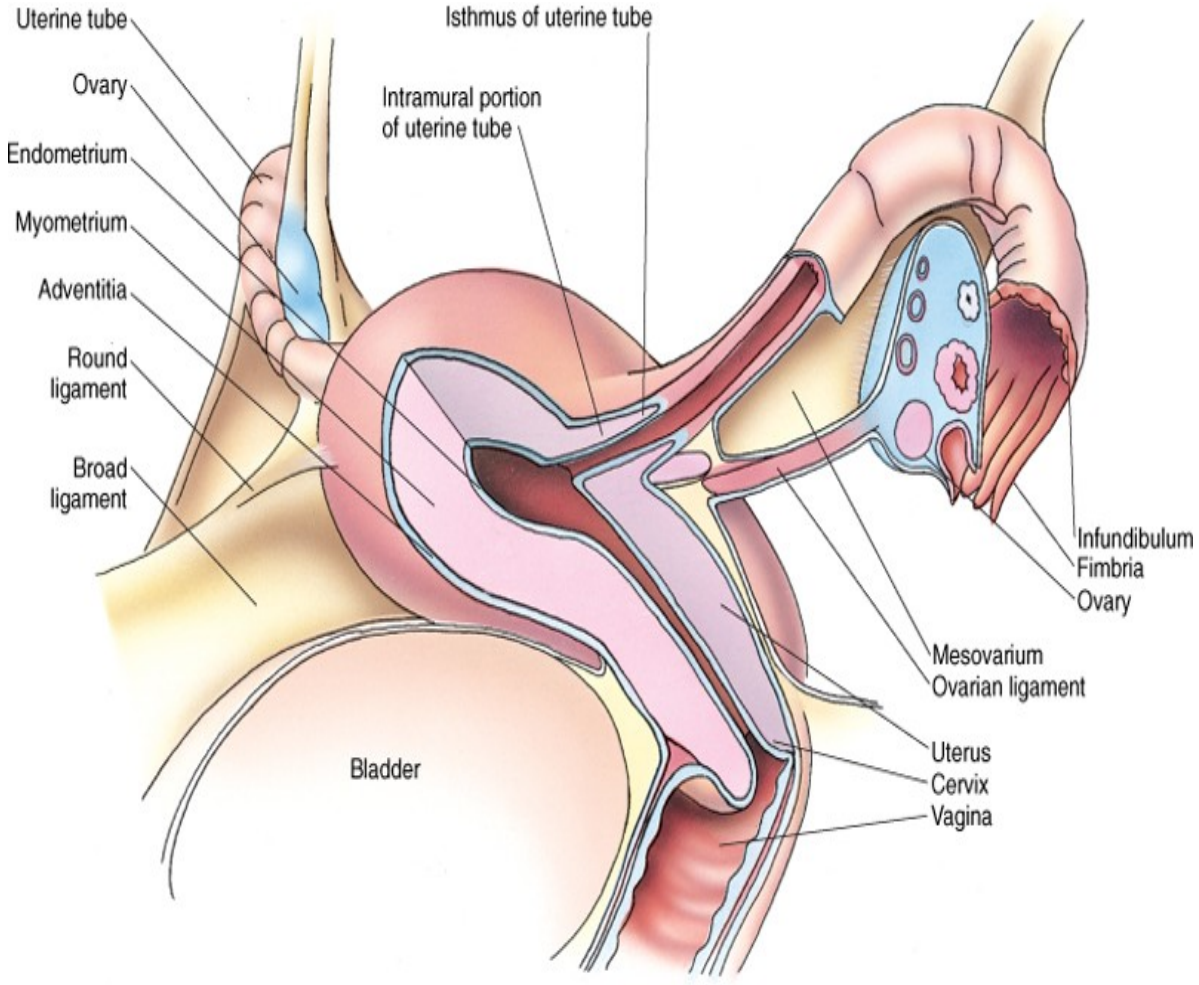
Uterus

- **It is a pear-shaped muscular organ in the pelvic cavity.**
- **Anatomically, it is formed of:**
  - **A. Fundus**
  - **B. Body**
  - **C. Cervix**
- **Histologically, The fundus and body are formed of 3 layers:**

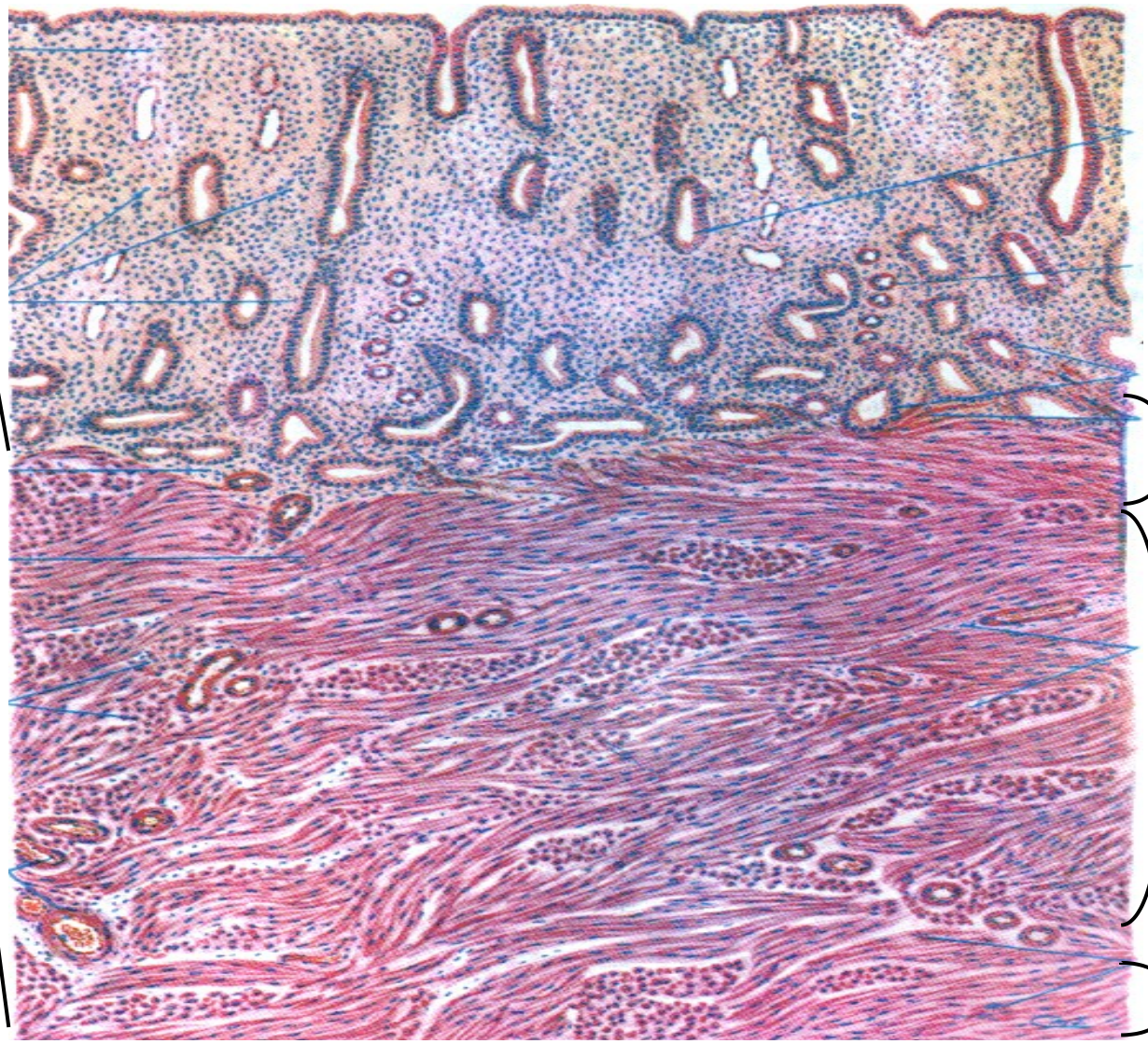
1. Endometrium

2. Myometrium

3. Perimetrium (serosa or adventitia)



Uterus



Endometrium

Myometrium

S. subvasculare

S. vasculare

S. supravasculare

1- ENDOMETRIUM

- **Endometrial mucosa is formed of :**

❑ **Epithelium: simple columnar ciliated and non-ciliated mucous secretory cells.**

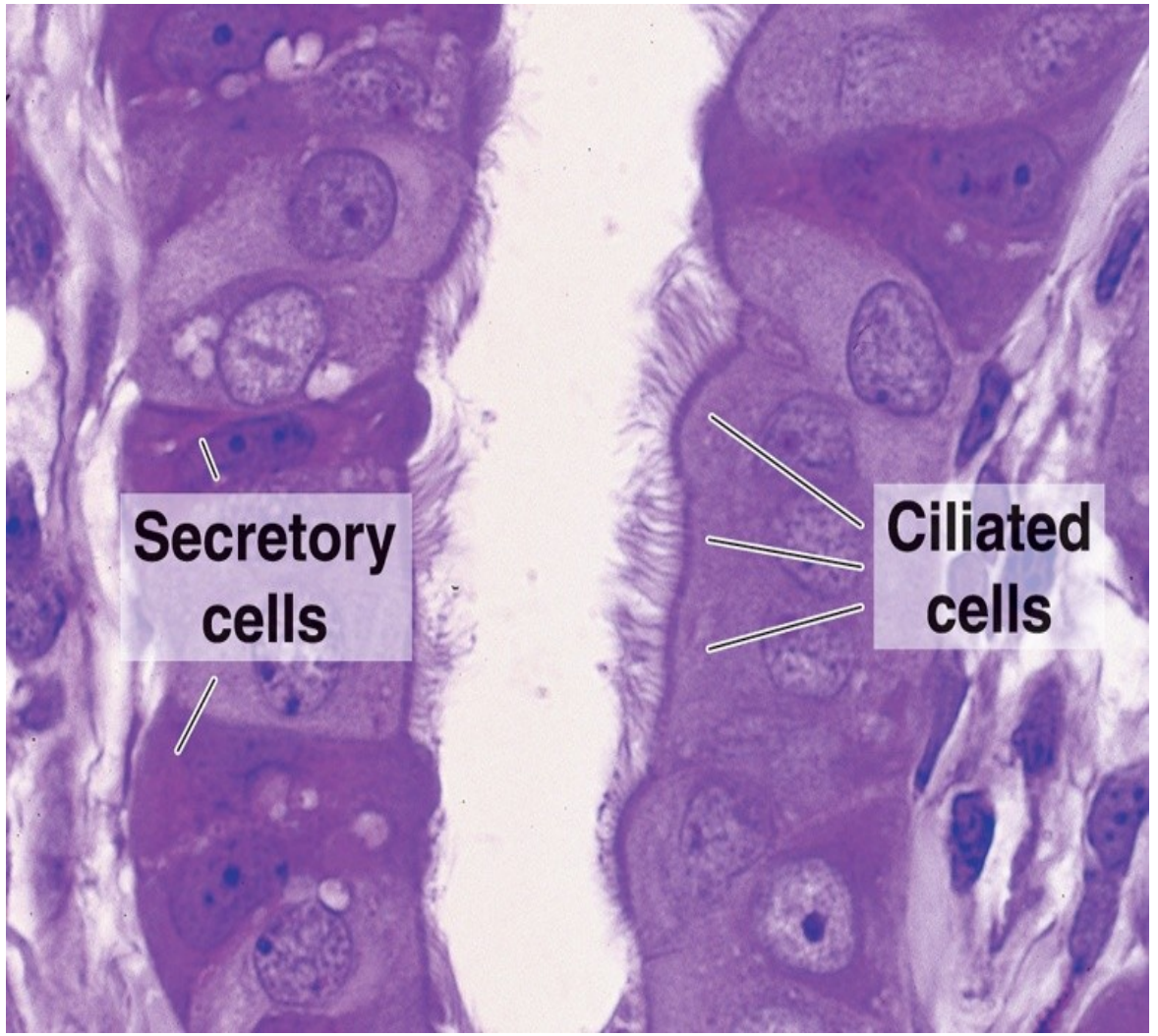
❑ **Lamina propria contains**

1- Uterine glands which are simple tubular glands.

2- Highly cellular stroma (stellate shaped cells→ called *decidual cells in case of pregnancy*.

3- Collagen, reticular fibers, lymphocytes, macrophages.

4- Uterine bl. vs.



Layers of endometrium

The endometrium is divided into 2 layers:

1-Functional layer or stratum functionale.

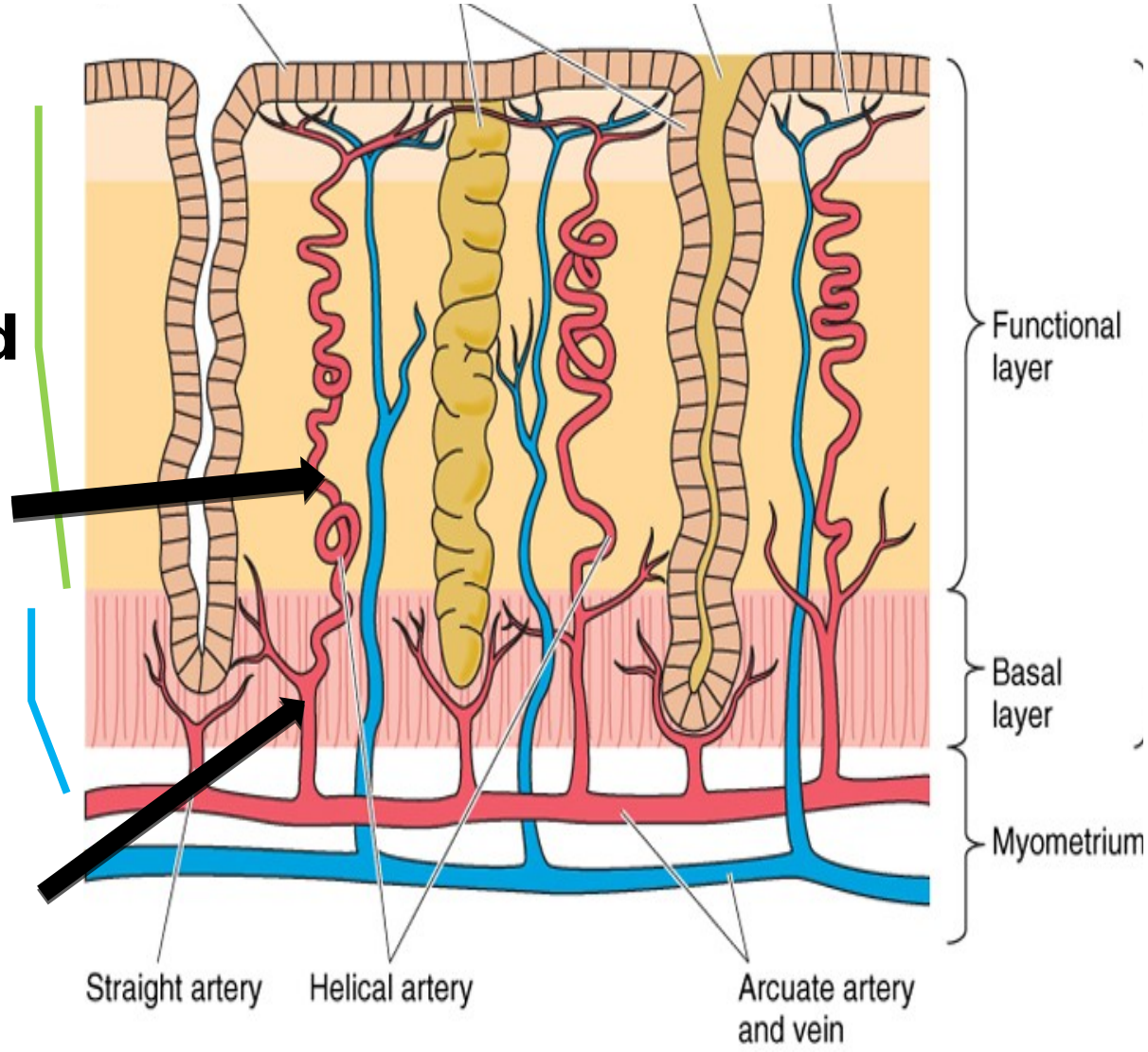
- **thick superficial portion → shed off at menstruation.**
- **supplied by spiral arteries (progesterone-sensitive).**

2-Basal layer or stratum basale.

- **thinner deeper permanent layer**

→ preserved during menstruation.

- **supplied by straight arteries (hormone- insensitive).**



2- MYOMETRIUM

- **It forms the main thickness of the uterine wall.**
- **It is formed of thick layers of smooth muscle fibers enclosing between them large blood vessels mostly veins.**
- **It forms a *structural and functional s***

Arise from it leiomyoma (fibroid)

Three layers of muscle can be distinguish

1. **S. subvasculare. (mostly longitudinal)**
2. **S. vasculare. (circular &oblique around blood vessel to give 8 shaped).**
3. **S. supravasculare. (mostly longitudinal)**

Hormonal effect on myometrium

- **1. Estrogen:**

- ↑ estrogen level during pregnancy → sm. ms are the largest **(hypertrophy)** and most numerous **(hyperplasia).**
- ↓ estrogen level at the end of menstruation → sm. ms are the smallest

- **2. Oxytocin:**

- During delivery, oxytocin together with **PGs** → stimulate uterine contraction very forcefully to expel the infant from the uterus.
- After delivery, oxytocin continues to stimulate uterine contraction → to inhibit excessive bleeding.
- Then sm.ms. shrink and some undergo apoptosis → to return the uterus to its pre-pregnancy size.

3- SEROSA OR ADVENTITIA

- **The fundus of uterus is covered by → peritoneum (broad ligament).**
- **The body is surrounded by → loose C.T. adventitia.**

Menstrual cycle

- Menstrual cycle starts usually between 12-15 years of age ***(menarche)*** and ceases between 45-50 years of age ***(menopause).***
- The duration of cycle is about **28** days in average.
- It begins on the day menstrual bleeding appears.
- The endometrium undergoes **cyclic changes** controlled by ovarian

LMP

1- Menstrual phase

Follicular (proliferative)

Luteal -3 (secretory) phase

I. MENSTRUAL PHASE

Time: 2 weeks after ovulation.
Duration: 3-5 days
Hormonal control: rapid drop in progesterone and estrogen due to C.L. degeneration (no pregnancy).
Histological changes:

- Functional layer of the endometrium → become necrotic → sloughed with unclotted blood& mucus → discharged through the vagina as menstrual fluid (menses).
- Basal layer is *not sloughed* and

Regeneration of endometrium occurs at 3 levels:

1- Stroma

2- Glandular tissue

3- Vascular element

II. PROLIFERATIVE (FOLLICULAR) PHASE

Time: begins by the end of menstrual flow (4th- 14th).

Duration: 10-12 days.

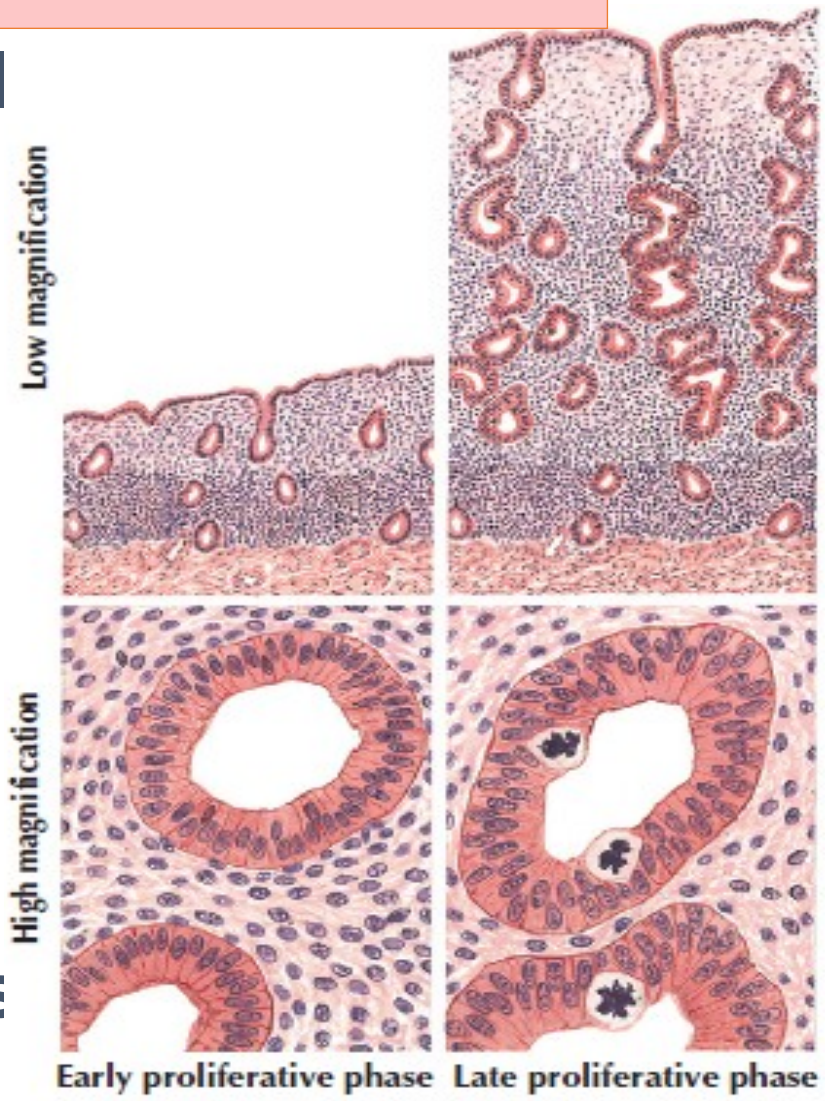
Hormonal control: **estrogen** from developing follicles.

Histological changes:

1- Stroma: → is renewed by **mitosis** of stromal cells.

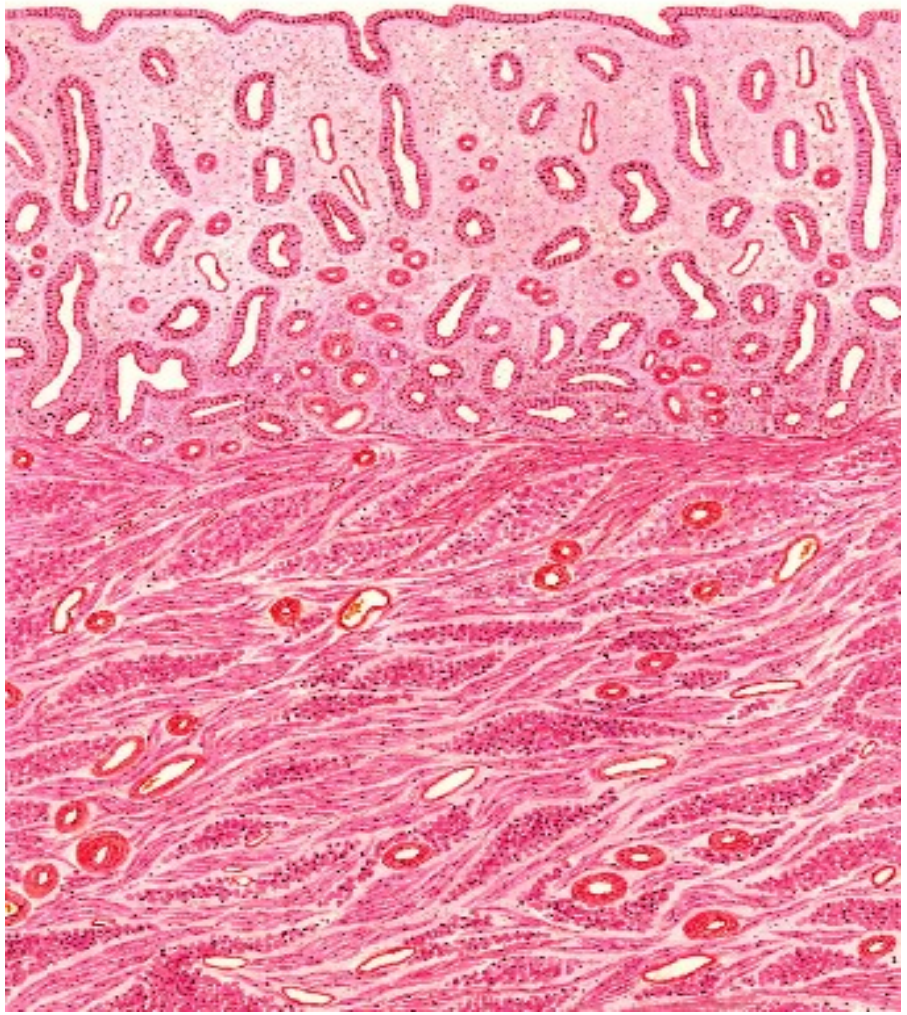
2- Glandular tissues: → is renewed by **proliferation** of cells of the basal part of the gland.

3- Vascular element: → basal arteries extend to the newly formed functional zone.



✓By the end of this phase:

Proliferative (follicular) phase

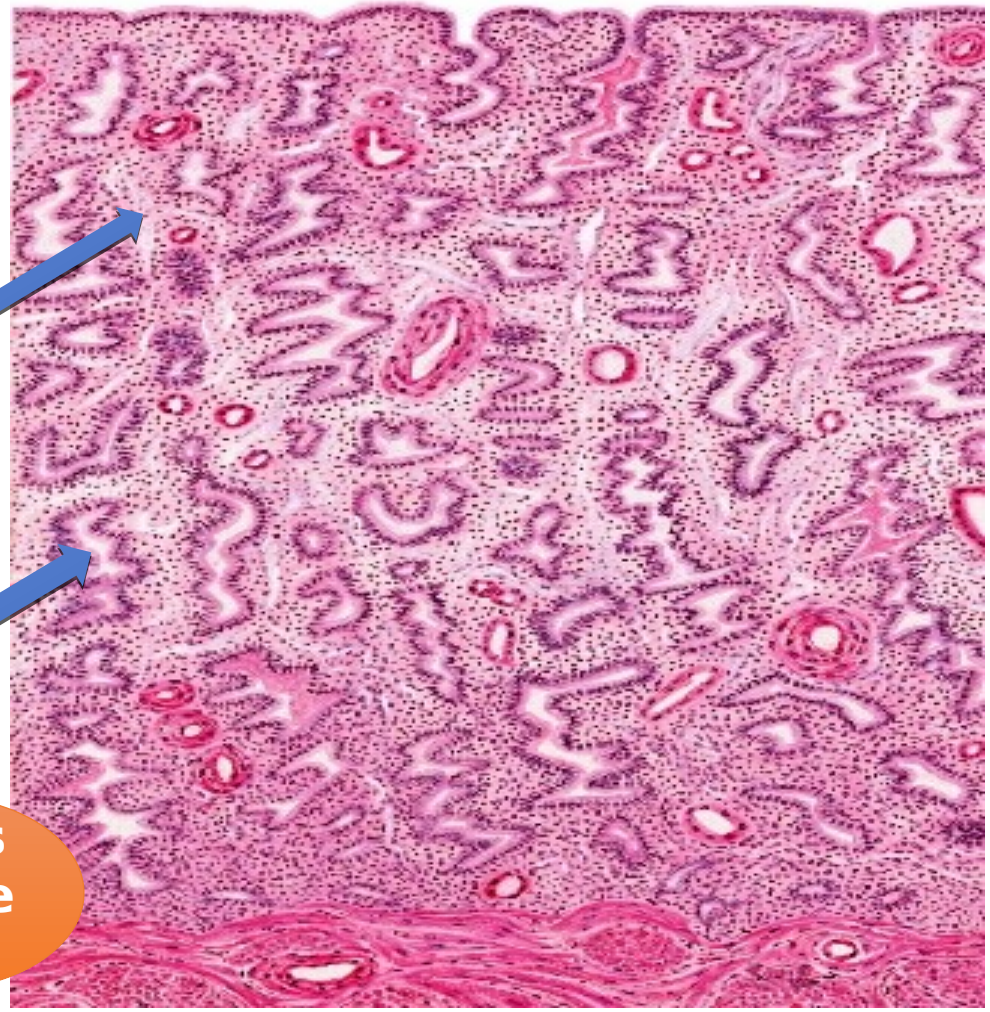


1. ***The endometrial thickness*** **is → 2-3 mm.**
2. ***The glands*** **are → straight, tubular with narrow lumen.**
3. ***The stroma*** **→ is highly cellular**
4. ***Coiled arteries*** **→ extend only 2\3 of the endometrium.**

III. SECRETORY (LUTEAL) PHASE

Time: shortly after ovulation.
Duration:14 days.
Hormonal control: progesterone secreted from corpus luteum.
Histological changes:

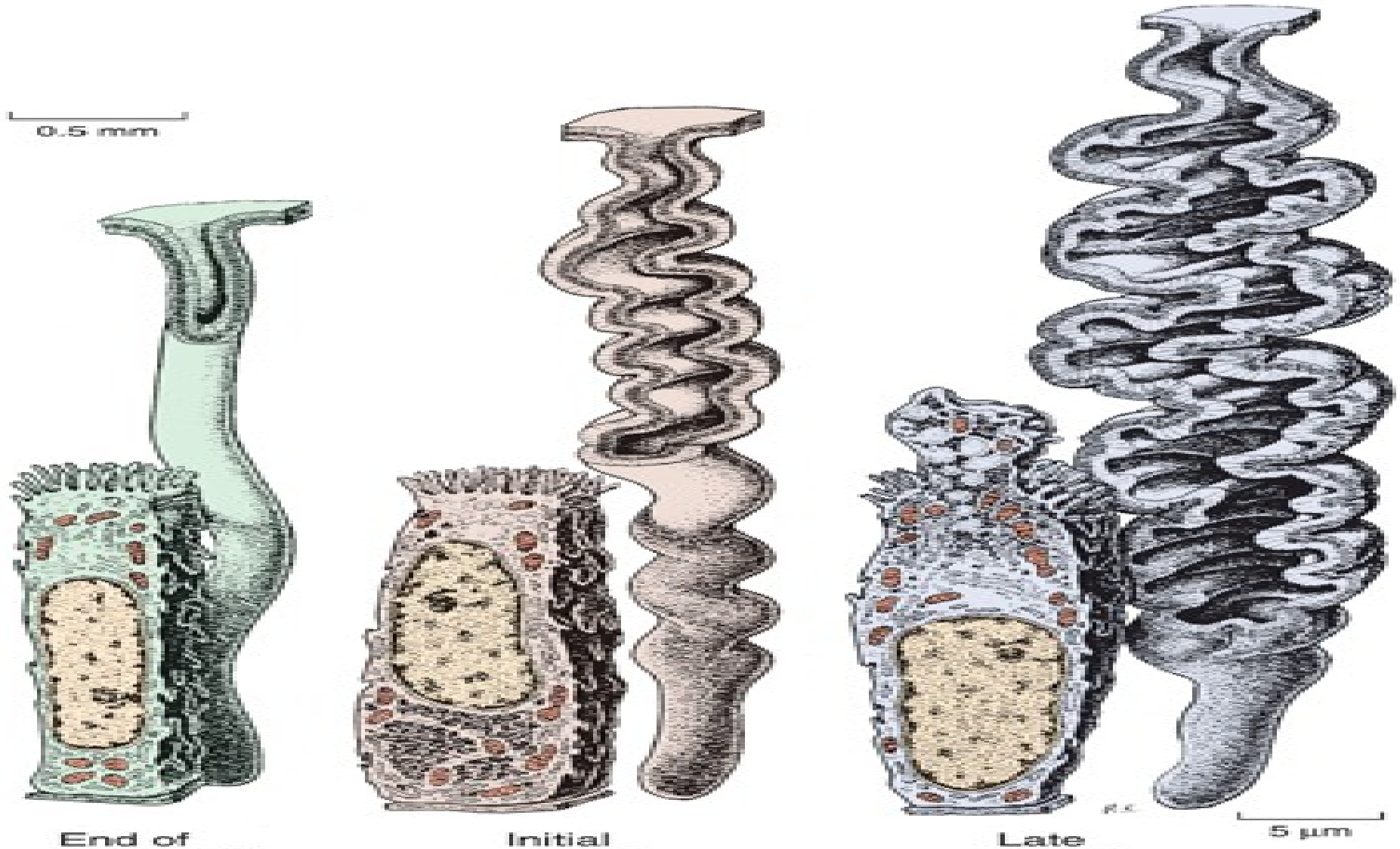
1- Stroma → thickened due to oedema of lamina propria.
2- Glandular tissue → glands become coiled, tortuous and cells accumulate glycogen.
3- Vascular → coiled arteries become longer.



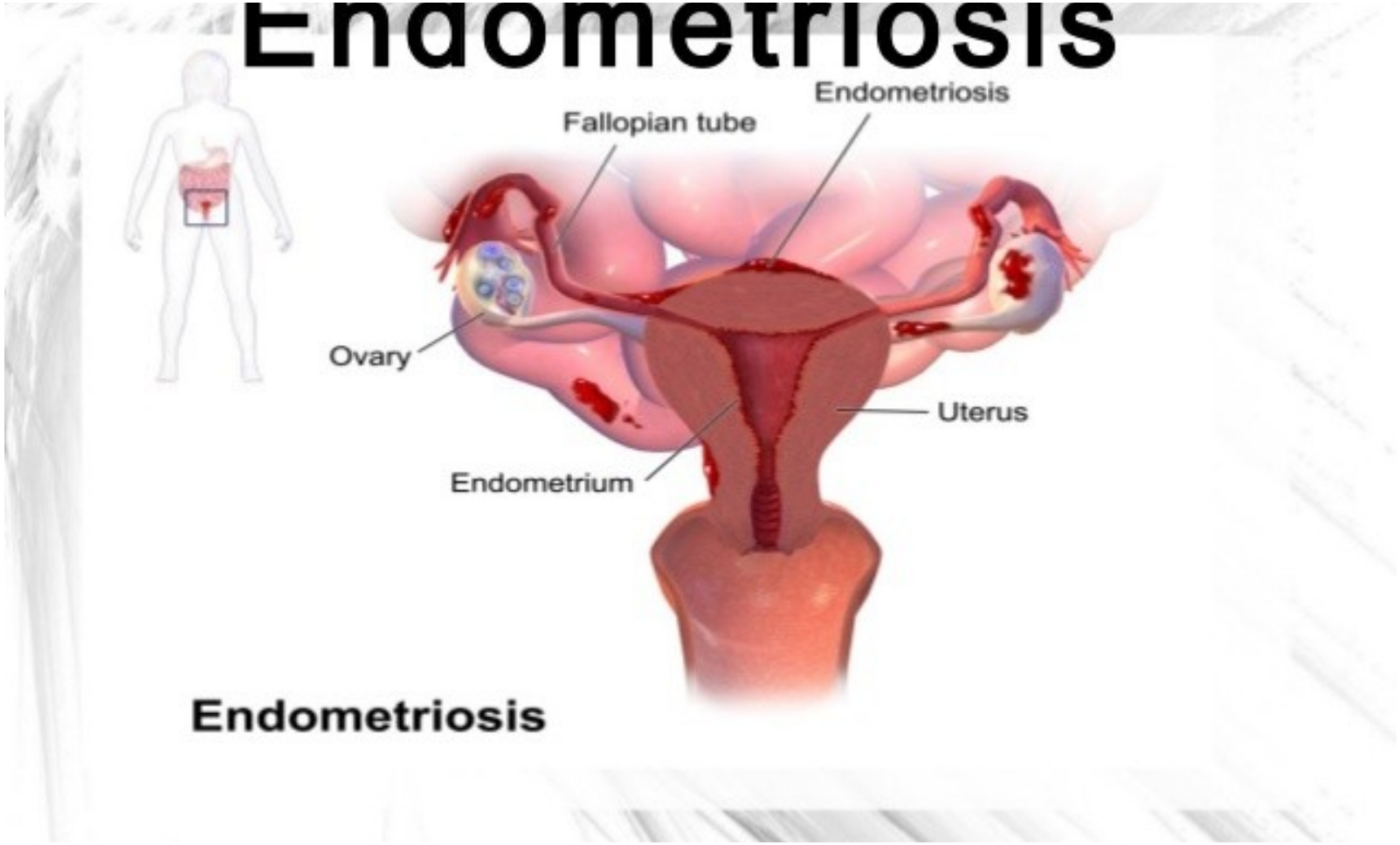
Low magnification
High magnification
Early secretory phase
Midsecretory phase

✓ **By the day 20 of the cycle:**

1. ***The endometrium*** → **reaches 4-6 mm thick.**
2. ***Glands*** → **coiled & filled with secretion.**
3. ***Stromal cells*** → **decidual reaction (glycogen & fat droplets)** →**which prepares the endometrium for reception of the fertilized ovum.**
4. ***Coiled arteries*** → **highly coiled and extend fully into functional layer.**

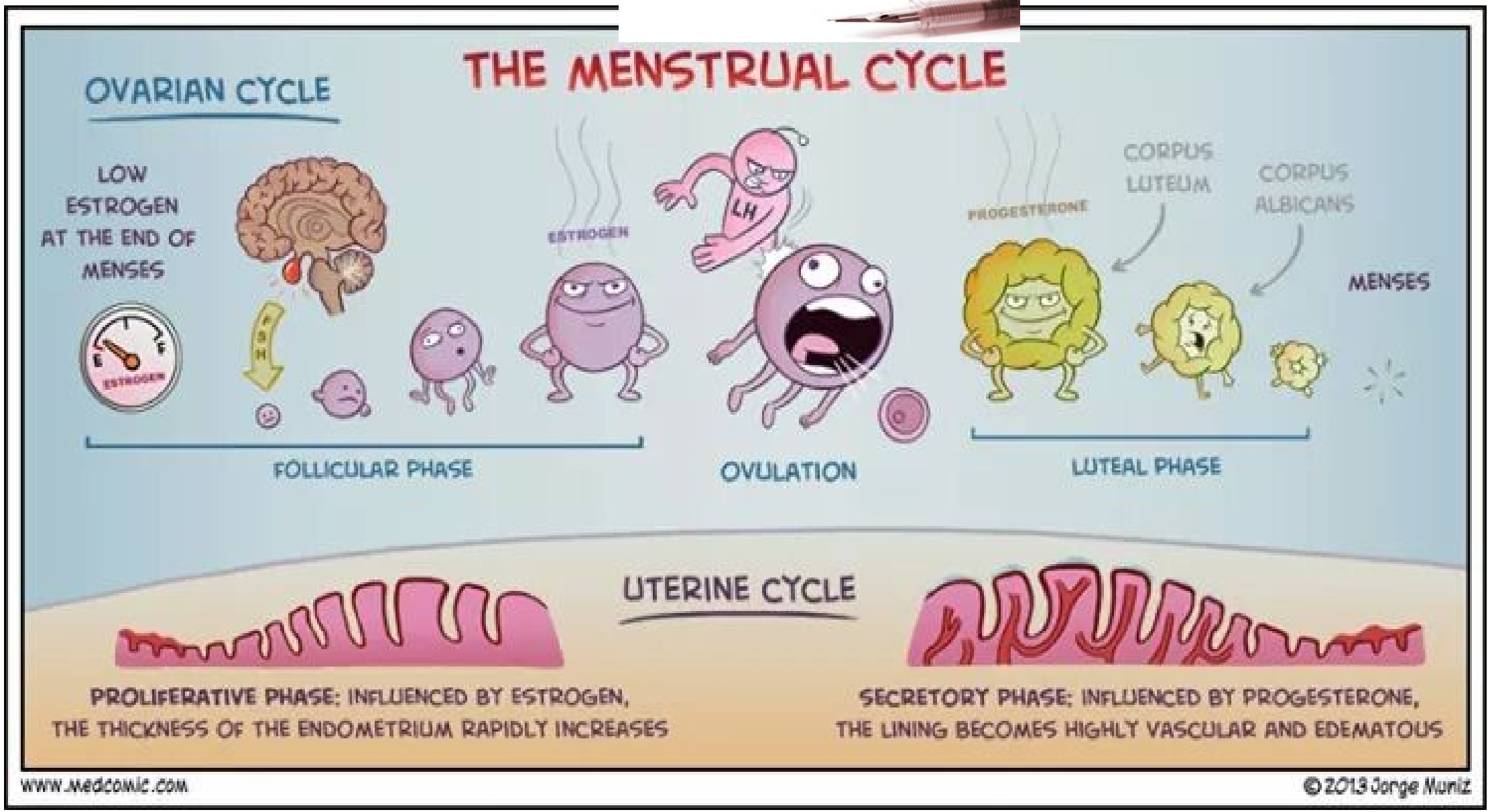

0.5 mm
5 µm
End of proliferative phase
Day 14
Initial secretory phase
Days 15–21
Late secretory phase
Days 22–28

Clinical Correlation

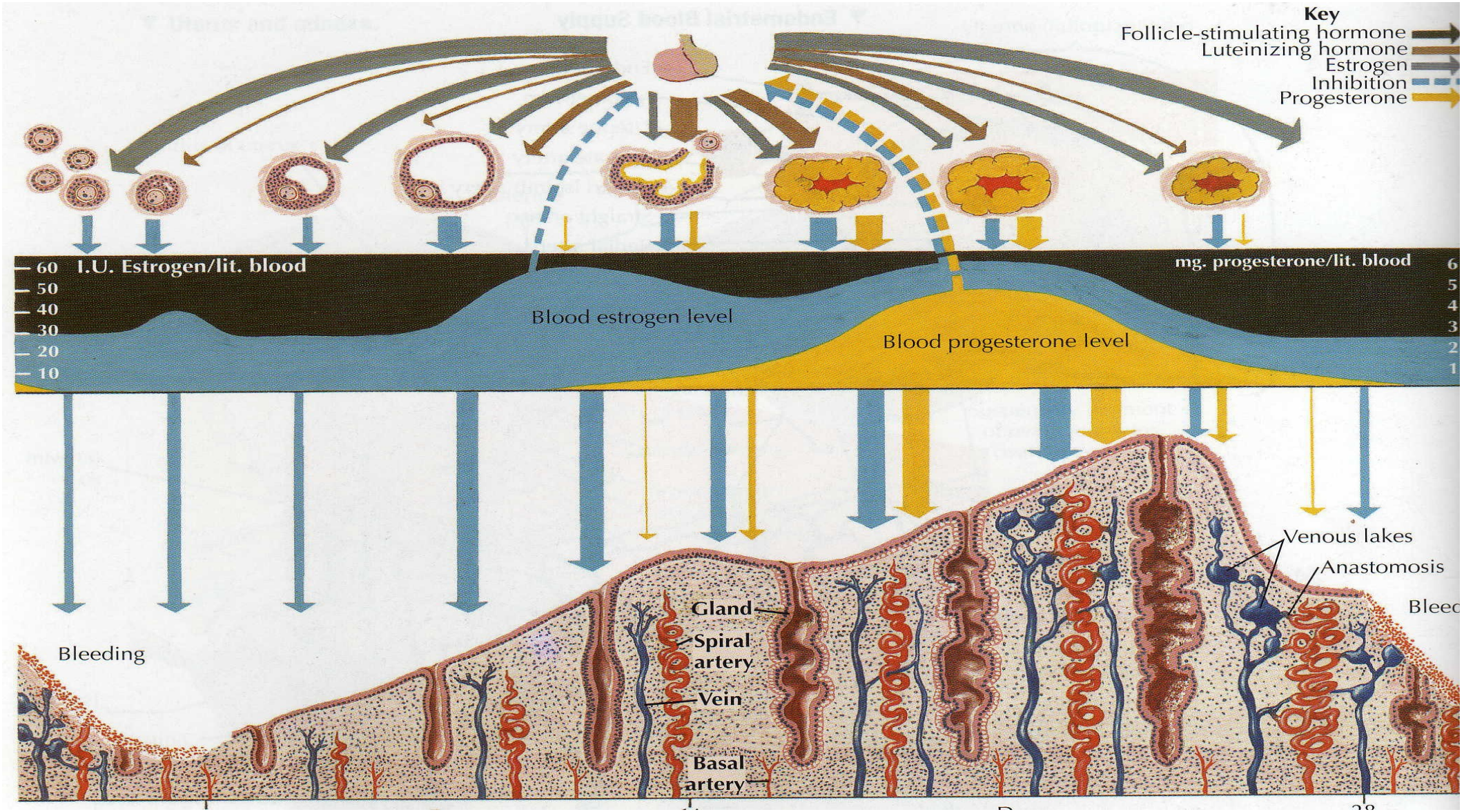


- **Endometriosis means presence of the endometrial tissue *outside uterine cavity* e.g. fallopian tube, ovaries, peritoneal cavity. Viable endometrial cells undergo menstrual reflux through uterine tube.**

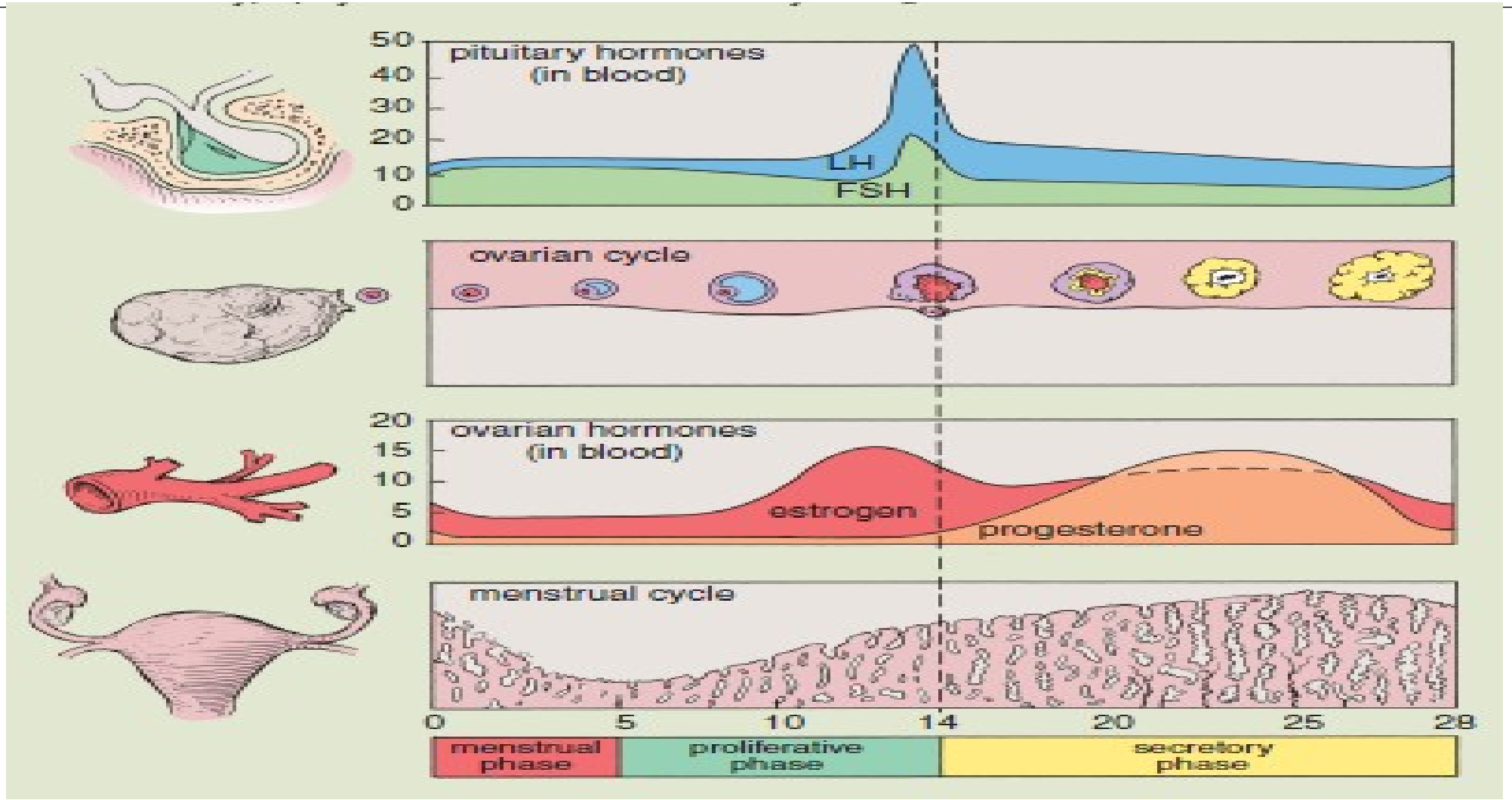
Activity

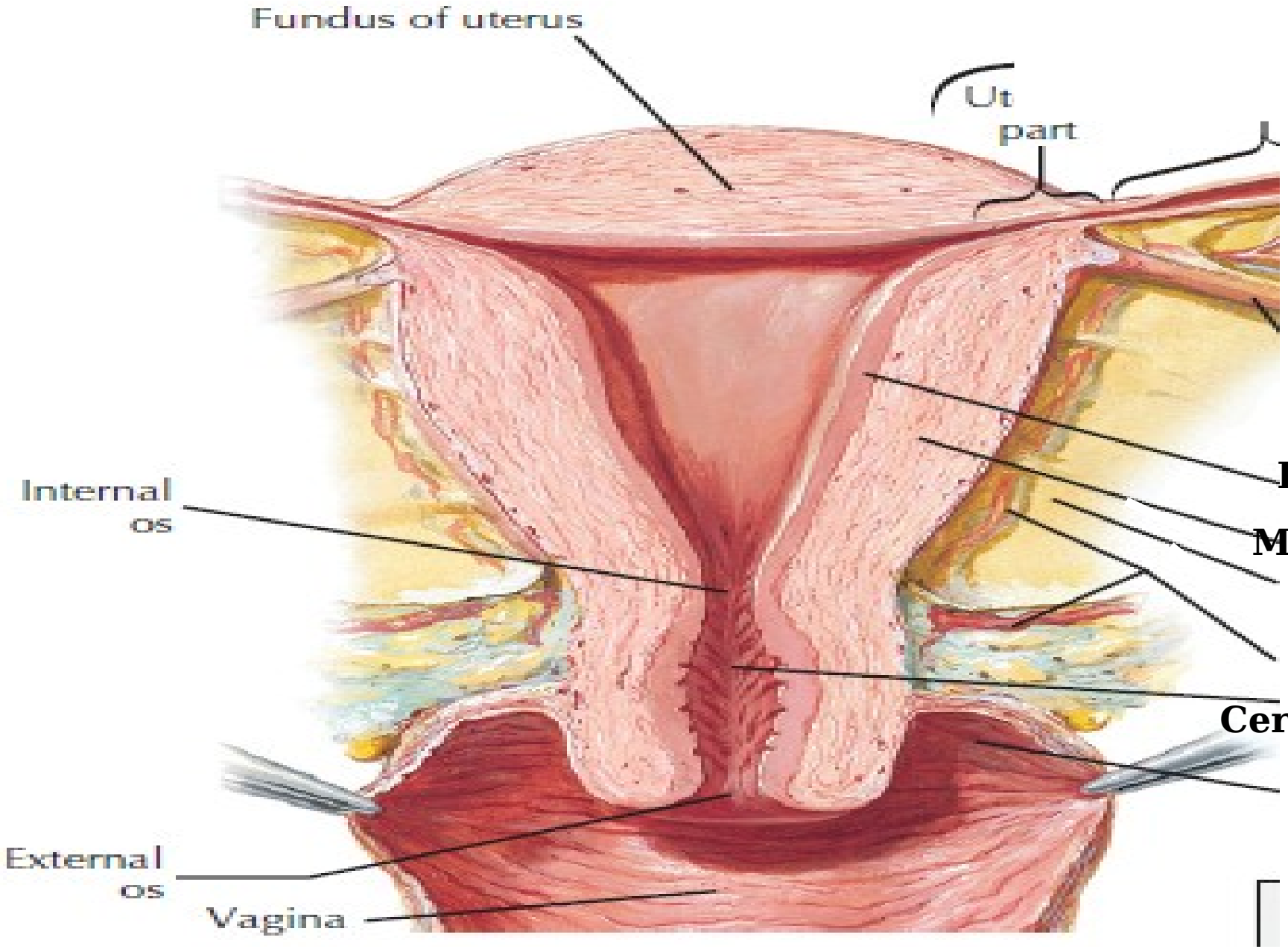

THE MENSTRUAL CYCLE
OVARIAN CYCLE
LOW ESTROGEN AT THE END OF MENSES
ESTROGEN
FSH
ESTROGEN
LH
PROGESTERONE
CORPUS LUTEUM
CORPUS ALBICANS
MENSES
FOLLICULAR PHASE
OVULATION
LUTEAL PHASE
UTERINE CYCLE
PROLIFERATIVE PHASE: INFLUENCED BY ESTROGEN, THE THICKNESS OF THE ENDOMETRIUM RAPIDLY INCREASES
SECRETORY PHASE: INFLUENCED BY PROGESTERONE, THE LINING BECOMES HIGHLY VASCULAR AND EDEMATOUS
www.medcomic.com
© 2013 Jorge Muniz

Menstrual cycle



Correlation of ovarian and menstrual cycles




Fundus of uterus
Ut
part
Internal
os
External
os
Vagina
Endometriu
m
Myometrium
Cervical canal

Cervix of the uterus

- The wall of cervix consists mainly of dense CT with few smooth muscle fibers.

Epithelial lining:

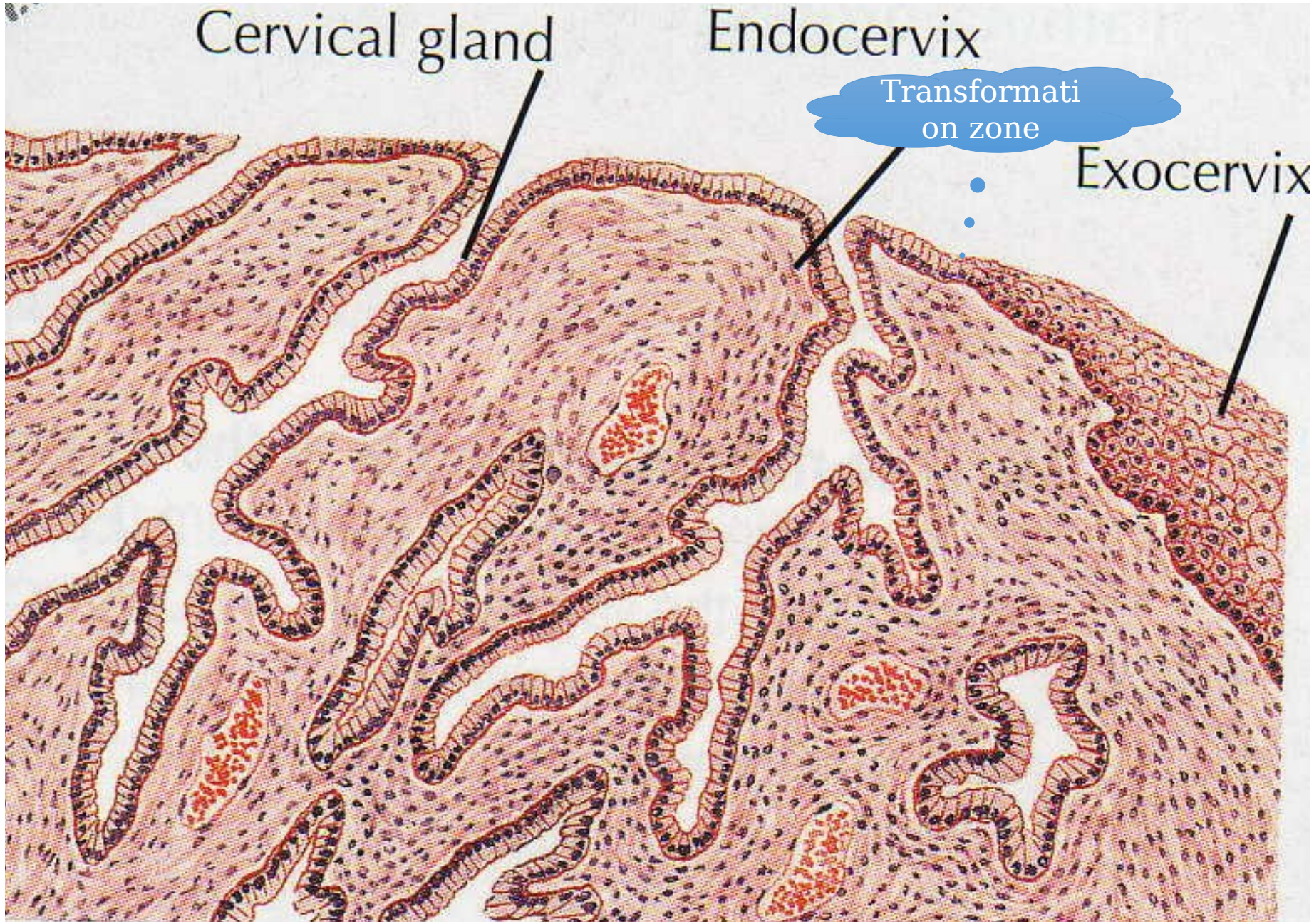
- Simple tall columnar mucous secreting.
- Just above the opening of the cervix (external os) the epithelium abruptly changes to stratified squamous non-keratinizing epithelium.

Lamina propria:

- CT containing branched tubuloalveolar glands secreting mucous.
- The cervix dilates during labour due to the effect of relaxin hormone.

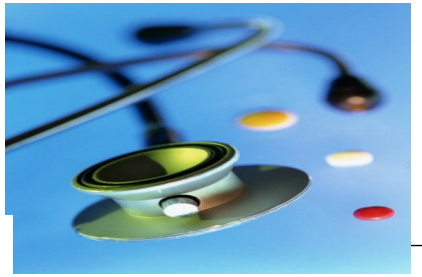
❑Cyclic changes of the cervix:

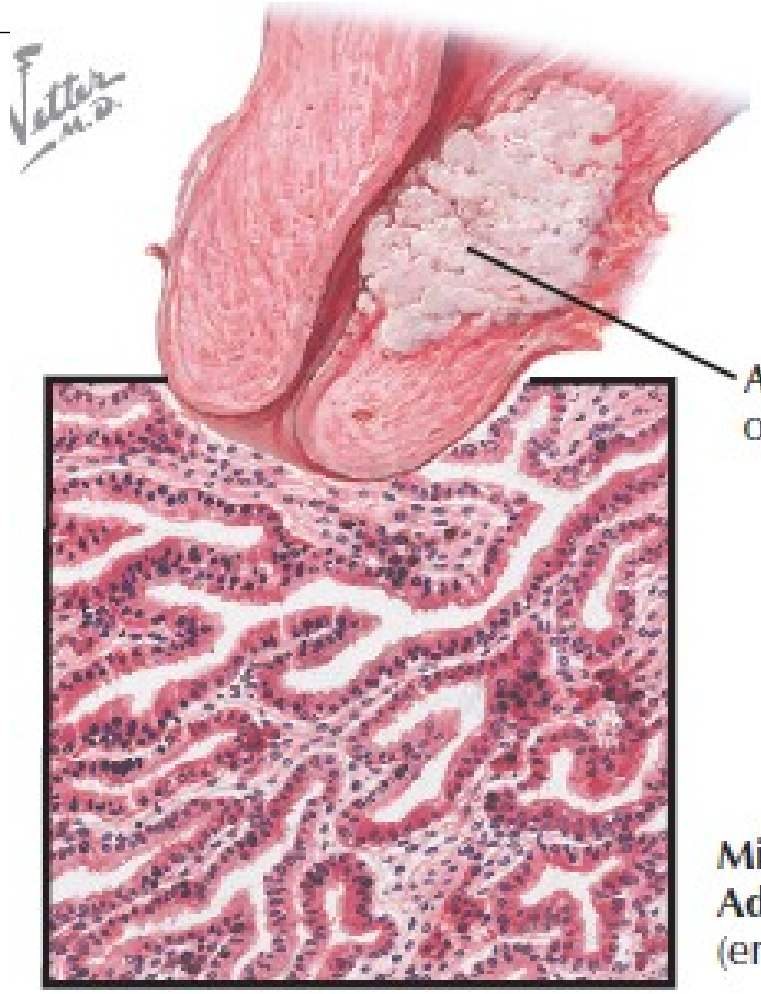
- The cervical mucosa is not shed during menstruation (WHY?), but cyclic changes occur in the amount and viscosity of the cervical secretion.
- At ovulation (watery), while at pregnancy or luteal phase (viscous→ mucus plug)---- > (WHY?)


Cervical gland
Endocervix
Transformati
on zone
Exocervix

Clinical Correlation

PAP Smear



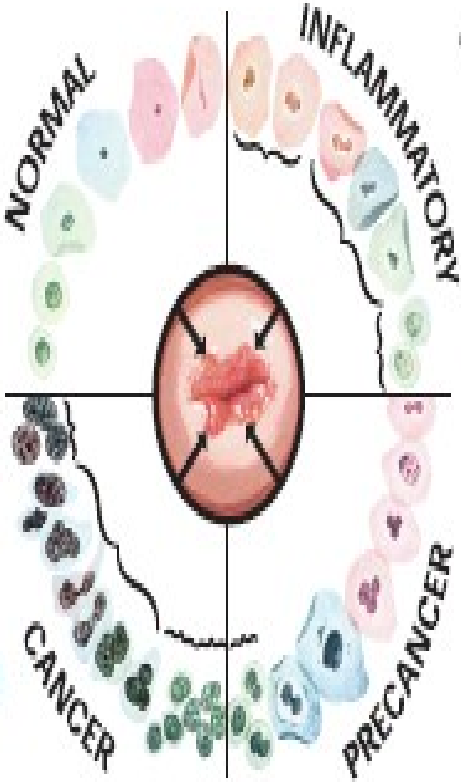


Cervical carcinoma: gross anatomic and microscopic views.

Advanced cancer. With invasion of the muscular wall.

Microscopic section: Adenocarcinoma (endocervical).

Exfoliative cytology of cervical scrapings to determine presence or absence of malignancy.



Cervical cell pathology in squamous tissue: grades and cell types.

Vagina

- **It is a fibro-muscular tube.**
- **Its wall *lacks glands ---- > How is the vagina lubricated?***

A- Mucosa:

- **Epithelium: stratified squamous non-keratinizing rich in:**

  a. Glycogen (so appear vacuolated) → fermented by vaginal bacteria → lactic acid → low pH → prevent bacterial invasion.

  b. Langerhans cells (APCs).

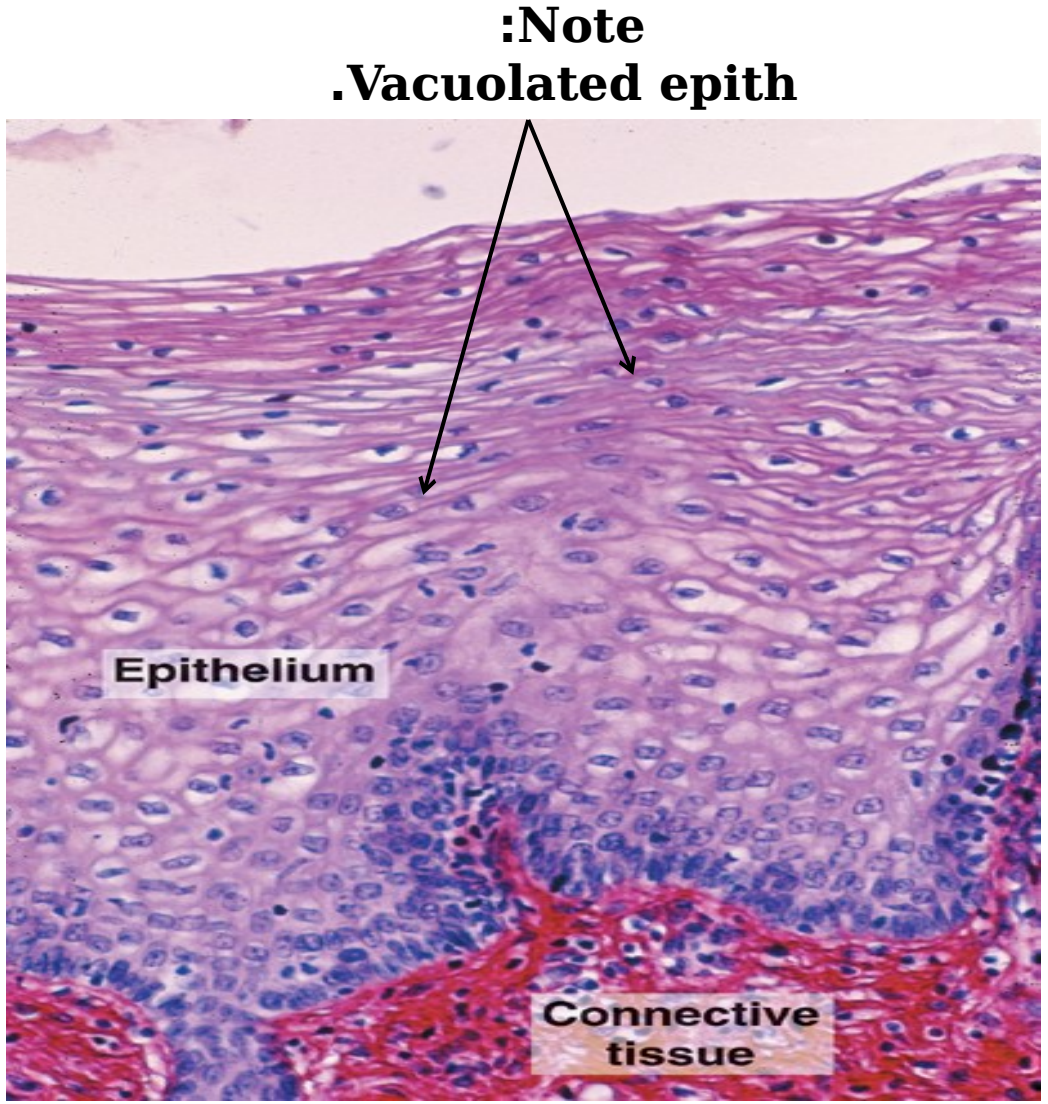
- **Lamina propria: C.T. rich in elastic & collagenous.**

  It contains extensive blood capillaries, lymphocytes and neutrophils.

B- Musculosa: I.C & O.L

C- Adventitia: fibroelastic C.T.

Vagina



- ***Cyclic changes of the vagina*:**

1. **Under influence of estrogen:**

- **↑ thickness of epithelium**
- **↑ synthesis and storage of glycogen & lipids**

2. **Under influence of progesterone:**

- **↑ desquamation of superficial cells and release of glycogen into vaginal lumen.**

Do you notice that.....

Estrogen induces proliferation

Progesterone induces secretion

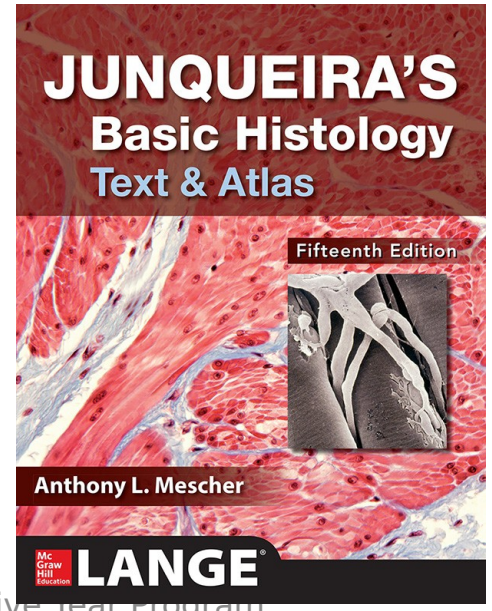
In all organs of female reproductive system

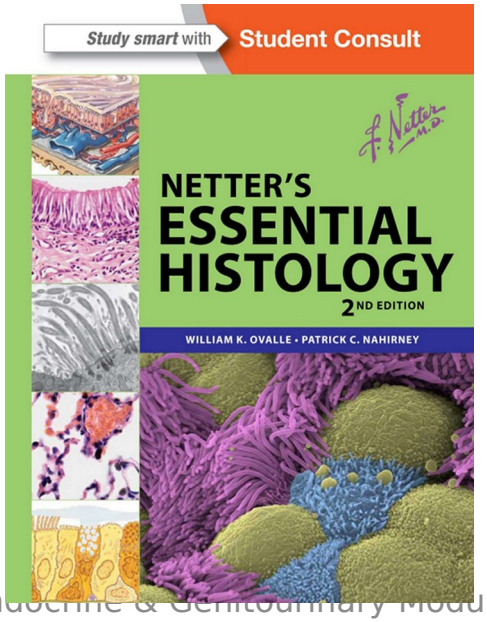
Assignment

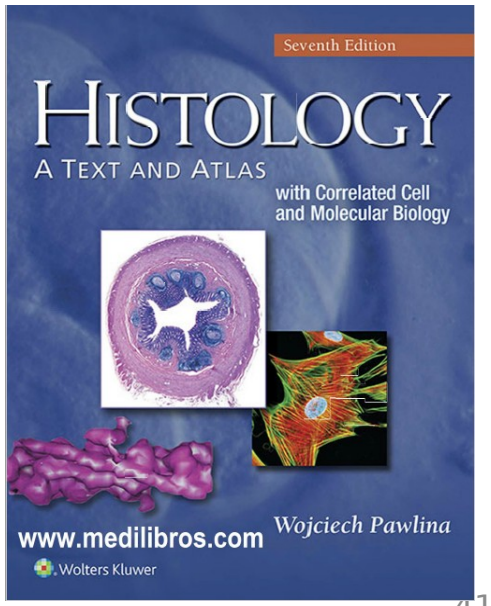
Compare histological differences between three phases of menstrual cycle.

SUGGESTED TEXTBOOKS

1. Junqueira's Basic Histology: Text and Atlas, 15th Edition by Anthony Mescher , 2018.
2. Michael H. Ross, Histology text and Atlas with correlated cell and molecular biology, 7th Edition, 2015.
3. Netter's Essential Histology, 2nd edition, 2013.








Thank You